



**Office of
Fissile Materials Disposition**

United States Department of Energy

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement

Volume I

June 1996

**For Further Information Contact:
U.S. Department of Energy**

Office of Fissile Materials Disposition, 1000 Independence Ave., SW, Washington, D.C. 20585

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United States Department of Energy
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Department of Energy

Washington, DC 20585

June 1996

Dear Interested Party:

The *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* is enclosed for your information. This document has been prepared in accordance with the National Environmental Policy Act, and reflects comments received on an earlier draft released in October 1995 for review by the public. The document presents the analyses of the environmental impacts of alternatives for the disposition of weapons-usable highly enriched uranium (HEU) that has been declared surplus to national defense needs.

The Department proposes to eliminate the proliferation threat of surplus HEU by blending it down to low enriched uranium (LEU), which is not weapons-usable. The EIS assesses the disposition of a nominal 200 metric tons of surplus HEU. The Preferred Alternative is, where practical, to blend the material for sale as LEU and use over time, in commercial nuclear reactor fuel to recover its economic value. Material that cannot be economically recovered would be blended to LEU for disposal as low-level radioactive waste.

In addition to the "No Action" Alternative, the HEU EIS analyzes four alternatives that represent different proportions of the resulting LEU being used in commercial reactor fuel or disposed of as waste. It analyzes the blending of HEU using three different processes at four potential sites. The transportation of materials is also analyzed.

A public comment period for the HEU Draft EIS was held from October 27, 1995 to January 12, 1996. Comments were received by letter, fax, electronic mail, and telephone recording. In addition, public workshops on the EIS were held in Knoxville, Tennessee and Augusta, Georgia in November, 1995. All comments were considered by the Department in preparing the Final EIS and are presented along with responses in Volume II of the document. A Record of Decision on surplus HEU disposition will be issued no sooner than 30 days following publication of the Notice of Availability of the HEU Final EIS in the Federal Register.

The Department appreciates the participation of outside organizations and the general public in the review of this document.

Sincerely,

J. David Nulton, Director
Office of NEPA Compliance and Outreach
Office of Fissile Materials Disposition



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COVER SHEET

Lead Federal Agency: U.S. Department of Energy (DOE)
Cooperating Federal Agency: U.S. Environmental Protection Agency

TITLE:

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement-Summary
(DOE/EIS-0240-S)

CONTACTS:

For further information on this environmental impact statement (EIS), call (202) 586-4513 or fax (202) 586-4078 or contact:

Mr. J. David Nulton
Director
Office of NEPA Compliance and Outreach
Office of Fissile Materials Disposition
U.S. Department of Energy
1000 Independence Ave., SW
Washington, D.C. 20585
(202) 586-4513

For further information on the U.S. Department of Energy/*National Environmental Policy Act* (NEPA) process, call (800) 472-2756 or contact:

Ms. Carol Borgstrom
Director
Office of NEPA Policy and Assistance (EH-42)
Office of Environment, Safety and Health
U.S. Department of Energy
1000 Independence Ave., SW
Washington, D.C. 20585
(202) 586-4600

ABSTRACT:

This document assesses the environmental impacts that may result from alternatives for the disposition of U.S.-origin weapons-usable highly enriched uranium (HEU) that has been or may be declared surplus to national defense or defense-related program needs. In addition to the No Action Alternative, it assesses four alternatives that would eliminate the weapons-usability of HEU by blending it with depleted uranium, natural uranium, or low-enriched uranium (LEU) to create LEU, either as commercial reactor fuel feedstock or as low-level radioactive waste. The potential blending sites are DOE's Y-12 Plant at the Oak Ridge Reservation in Oak Ridge, Tennessee; DOE's Savannah River Site in Aiken, South Carolina; the Babcock & Wilcox Naval Nuclear Fuel Division Facility in Lynchburg, Virginia; and the Nuclear Fuel Services Fuel Fabrication Plant in Erwin, Tennessee. Evaluations of impacts at the potential blending sites on site infrastructure, water resources, air quality and noise, socioeconomic resources, waste management, public and occupational health, and environmental justice are included in the assessment. The intersite transportation of nuclear and hazardous materials is also assessed. The Preferred Alternative is blending down as much of the surplus HEU to LEU as possible while gradually selling the commercially usable LEU for use as reactor fuel. DOE plans to continue this over an approximate 15- to 20-year period, with continued storage of the HEU until blend down is completed.

PUBLIC INVOLVEMENT:

The Department of Energy issued a HEU Draft EIS on October 27, 1996, and held a formal public comment period on the HEU Draft EIS through January 12, 1996. In preparing the HEU Final EIS, DOE considered comments received via mail, fax, electronic bulletin board (Internet), and transcribed from messages recorded by telephone. In addition, comments and concerns were recorded by notetakers during interactive public hearings held in Knoxville, Tennessee, on November 14, 1995, and Augusta, Georgia, on November 16, 1995. These comments were also considered during preparation of the HEU Final EIS. Comments received and DOE's responses to those comments are found in Volume II of the EIS.



DOE/EIS-0240

Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement

Volume I

**United States Department of Energy
Office of Fissile Materials Disposition**

June 1996

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LIST OF ACRONYMS AND ABBREVIATIONS

ABB-CE	Asea Brown-Boveri Combustion Engineering
ALARA	as low as reasonably achievable
AQCR	Air Quality Control Region
ASTM	American Society of Testing Materials
B&W	Babcock & Wilcox
BEIR	Biological Effects of Ionizing Radiation
CEQ	Council on Environmental Quality
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act</i>
CNFP	Commercial Nuclear Fuel Plant
CRT	cargo restraint transportation
CSXT	CSX Transportation
CWA	<i>Clean Water Act</i>
DNL	day/night average sound levels
DOE	Department of Energy
DOT	Department of Transportation
DU	depleted uranium
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency
ES&H	Environmental, Safety, and Health
FEMA	Federal Emergency Management Agency
FFCA	<i>Federal Facility Compliance Agreement</i>
FONSI	Finding of No Significant Impact
GE	General Electric
HEPA	high-efficient particulate air
HEU	highly enriched uranium
HEU EIS	<i>Disposition of Surplus Highly Enriched Uranium Environmental Impact Statement</i>
HI	Hazard Index
HLW	high-level waste
HQ	Hazard Quotient
I	Interstate highways
IAEA	International Atomic Energy Agency
IDLH	Immediately Dangerous to Life or Health
INEL	Idaho National Engineering Laboratory
IP	implementation plan
IRIS	Integrated Risk Information System
LANL	Los Alamos National Laboratory
LEU	low-enriched uranium
LLNL	Lawrence Livermore National Laboratory
LLW	low-level waste
MEI	maximally exposed individual
MOU	memorandum of understanding
NAAQS	National Ambient Air Quality Standards
NEPA	<i>National Environmental Policy Act of 1969</i>
NERP	National Environmental Research Park
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFS	Nuclear Fuel Services

NNFD	Naval Nuclear Fuel Division
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NS	Norfolk Southern Railroad
NTS	Nevada Test Site
NU	natural uranium
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
PEIS	programmatic environmental impact statement
POTW	Publicly Owned Treatment Works
PSD	Prevention of Significant Deterioration
RCRA	<i>Resource Conservation and Recovery Act</i>
REA	regional economic area
RFI	Remedial Feasibility Investigation
ROD	Record of Decision
ROI	region of influence
SAR	Safety Analysis Report
SNL	Sandia National Laboratories
SR	State Route highways
SRS	Savannah River Site
SRS IMNM EIS	<i>Savannah River Site Interim Management of Nuclear Materials Environmental Impact Statement</i>
SST	safe secure trailer
STEL	Short-Term (15-minute) Exposure Limits
SWU	Separative Work Unit
TDEC	Tennessee Department of Environment and Conservation
TDS	total dissolved solids
TLV	Threshold Limit Values
TRU	transuranic
TSCA	<i>Toxic Substance Control Act</i>
TSP	total suspended particulates
TWA	Time (8-hour) Weighted Average
USEC	United States Enrichment Corporation
VOC	volatile organic compounds
VRM	Visual Resource Management
Y-12 EA	<i>Environmental Assessment for the Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y-12 Plant, Oak Ridge, Tennessee</i>

CHEMICALS AND UNITS OF MEASURE

Al ₂ O ₃	aluminum oxide
BeO	beryllium oxide
BGY	billion gallons per year
Bq	becquerel
BTU	British Thermal Units
°C	degrees Celsius
Ci	curie
cm	centimeter
cm ³	cubic centimeter
CO	carbon monoxide
CO ₃	carbonate
dBA	decibel A-weighted
°F	degrees Fahrenheit
ft	feet
ft ²	square feet
ft ³	cubic feet
F ₂	fluorine
g	gram
gal	gallon
GPD	gallons per day
ha	hectare
H ₂	hydrogen
H ₂ O	water
HCO ₃	bicarbonate
HF	hydrogen fluoride
HNO ₃	nitric acid
hr	hour
in	inch
kg	kilogram
km	kilometer
km ²	square kilometer
l	liter
lb	pound
m	meter
m ²	square meter
m ³	cubic meter
mCi	millicurie
mg	milligram
MGD	million gallons per day
MGY	million gallons per year
mi	mile
mi ²	square mile
mrem	millirem (one thousandth of a rem)
MTU	metric ton uranium
MWe	megawatt electric

MWh	megawatt hour
N ₂	nitrogen
NaOH	sodium hydroxide
nCi	nanocurie (one-billionth of a Curie)
NO ₂	nitrogen dioxide
NO ₃	nitrogen trioxide
O ₃	ozone
Pb	lead
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
pCi	picocurie (one-trillionth of a Curie)
PM ₁₀	particulate matter (less than 10 microns)
ppm	parts per million
Pu	plutonium
Pu-238	plutonium-238
Pu-239	plutonium-239
Ra-226	radium-226
rem	roentgen equivalent man
Rn-222	radon-222
s	second
SO ₂	sulfur dioxide
t	metric ton
Tc-99	technetium-99
Th-230	thorium-230
Th-234	thorium-234
TCE	trichloroethylene
U	uranium
U/Al	uranium-aluminum
U-232	uranium-232
U-234	uranium-234
U-235	uranium-235
U-236	uranium-236
U-238	uranium-238
UF ₄	uranium tetrafluoride
UF ₆	uranium hexafluoride
UNH	uranyl nitrate hexahydrate
UO ₂	uranium dioxide
UO ₃	uranium trioxide
U ₃ O ₈	triuranic octaoxide
yr	year
µCi	microcurie (one-millionth of a curie)
µg	microgram (one-millionth of a gram)
µohms/cm	resistance per centimeter

METRIC CONVERSION CHART

To Convert Into Metric			To Convert Out of Metric		
If You Know	Multiply By	To Get	If You Know	Multiply By	To Get
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.40469	hectares	hectares	2.471	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45360	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Force					
dynes	.00001	newtons	newtons	100,000	dynes
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

The numbers (estimated by models or calculated, not those obtained from references) in this document have been rounded using engineering judgment to facilitate reading and understanding of the document. Because numbers have been rounded, converting these numbers from metric to English using the conversion table above will give answers not consistent within the text.

METRIC PREFIXES

Prefix	Symbol	Multiplication Factor
exa-	E	$1\ 000\ 000\ 000\ 000\ 000\ 000 = 10^{18}$
peta-	P	$1\ 000\ 000\ 000\ 000\ 000\ 000 = 10^{15}$
tera-	T	$1\ 000\ 000\ 000\ 000 = 10^{12}$
giga-	G	$1\ 000\ 000\ 000 = 10^9$
mega-	M	$1\ 000\ 000 = 10^6$
kilo-	k	$1\ 000 = 10^3$
hecto-	h	$100 = 10^2$
deka-	da	$10 = 10^1$
deci-	d	$0.1 = 10^{-1}$
centi-	c	$0.01 = 10^{-2}$
milli-	m	$0.001 = 10^{-3}$
micro-	μ	$0.000\ 001 = 10^{-6}$
nano-	n	$0.000\ 000\ 001 = 10^{-9}$
pico-	p	$0.000\ 000\ 000\ 001 = 10^{-12}$
femto-	f	$0.000\ 000\ 000\ 000\ 001 = 10^{-15}$
atto-	a	$0.000\ 000\ 000\ 000\ 000\ 001 = 10^{-18}$